A STUDY ON CLINICAL, FUNCTIONAL AND RADIOLOGICAL OUTCOME OF HIGH VELOCITY TIBIAL PLATEAU FRACTURES MANAGED BY DUAL PLATING

Dissertation submitted to

M.S. DEGREE
BRANCH - II

ORTHOPAEDIC SURGERY

THE TAMILNADU DR.M.G.R.MEDICAL UNIVERSITY

CHENNAI-TAMILNADU

APRIL 2016

CERTIFICATE

This is to certify that this dissertation titled **"A STUDY ON CLINICAL, FUNCTIONAL AND RADIOLOGICAL OUTCOME OF HIGH VELOCITY TIBIAL PLATEAU FRACTURES MANAGED BY DUAL PLATING"** is a bonafide record of work done by **Dr.R.Manoj Kumar,** during the period of his postgraduate study from August 2013 to August 2015 under guidance and supervision in the Department of Orthopaedics, **Govt. Kilpauk Medical College Hospital**, Chennai-10., in partial fulfilment of the requirement for **M.S.Orthopaedic Surgery** degree examination of **The Tamilnadu Dr.M.G.R. Medical University** to be held in April 2016.

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DECLARATION

I declare that this dissertation entitled **"A Study on Clinical, Functional and Radiological Outcome of High Velocity Tibial Plateau Fractures managed by Dual Plating "** submitted by me for the degree of M.S. is the record of work carried out by me during the period of **August 2013 to August 2015** under the guidance of **Prof.N.Nazeer Ahmed, M.S.Ortho., D.Ortho,** Professor and Head of the department, Department of Orthopaedics, Govt. Kilpauk Medical College Hospital, Chennai. This dissertation is submitted to **The Tamilnadu Dr.M.G.R. Medical University**, Chennai, in partial fulfilment of the University regulations for the award of degree of **M.S.ORTHOPAEDICS (BRANCH-II)** examination to be held in April 2016.

Place: Chennai
Date:

Signature of the Candidate
(Dr.R.MANOJ KUMAR)

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I express my sincere thanks and I am extremely grateful to my Unit Chief, ***Prof. N.Nazeer Ahmed M.S.Ortho.,D.Ortho,*** Professor and Head of the Department, Department of Orthopaedics Govt. Kilpauk Medical College Hospital, Chennai, whose blessings had elevated me to this level, to conduct the study successfully. I am extremely lucky to have this noble hearted professor as my chief without whose valuable suggestions, expert guidance and constant encouragement this study would not have been possible.

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I thank all Anaesthesiologists and staff members of the theatre and wards for their endurance during this study. I am grateful to all my post graduate colleagues for helping in this study.

Last but not least, I sincerely thank all our patients , without whom this study would not have been possible.

INSTITUTIONAL ETHICAL COMMITTEE
GOVT.KILPAUK MEDICAL COLLEGE,
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Protocol ID. No.10/02/2015 Dt:01/02/2015

CERTIFICATE OF APPROVAL

The Institutional Ethical Committee of Govt. Kilpauk Medical College, Chennai reviewed and discussed the application for approval "A study on functional and radiological outcome of high velocity tibial plateau fractures managed by dual plating"- For Project Work submitted by Dr.R.Manojkumar, Post Graduate in MS (Ortho), Govt. Kilpauk Medical College, Chennai.

The Proposal is APPROVED.

The Institutional Ethical Committee expects to be informed about the progress of the study any Adverse Drug Reaction Occurring in the Course of the study any change in the protocol and patient information /informed consent and asks to be provided a copy of the final report.

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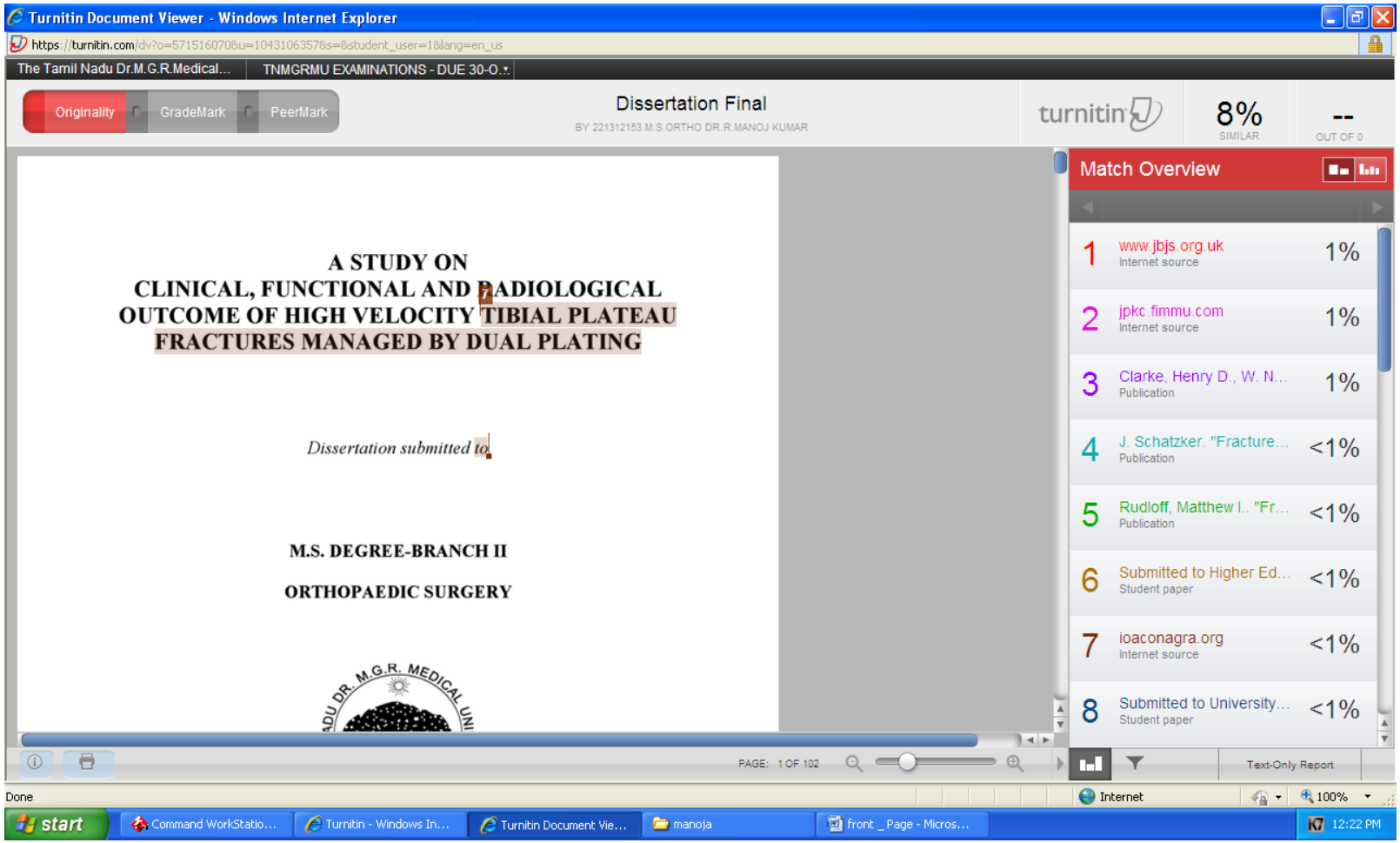
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CONTENTS

INTRODUCTION

INTRODUCTION

Tibial plateau fractures are intra-articular fractures of major weight bearing joint [1]. These fractures represent a wide spectrum of severity which ranges from simple injuries with predictable excellent outcome after nonperative treatment to complex fracture patterns, that challenge even most experienced surgeons[2].

Tibial plateau fractures represent approximately 1 % of fractures in adults[2]. These fractures occur commonly in 3rd to 5th decade age group. In young adult, motor vehicle accidents, bumper strike injuries are common mode of injury as opposed to elderly with sports injuries and fall as more common mode of injury[3].

Schatzker's type V &VI fractures occur due to high velocity trauma. They contribute to 20 – 40 % of tibial plateau fractures[4].They include bicondylar fractures & proximal metadiaphyseal dissociation fractures. In these fractures **local soft tissue injury, compartment syndrome, associated ligament instability** has to looked for[3] .

The controversy of surgical vs conservative management for high velocity tibial plateau fractures is overcome by enlightening the goals for

operative management which are anatomic reduction, restoration of articular congruity and alignment, stable fixation to allow early knee motion[5].

Among wide spectrum of operative management Dual plating via two incision is preferred technique as it has its own advantages when compared to other modalities of treatment such as Isolated Lateral locking plate, Hybrid external fixator, Ilizarov, LISS. Hence this study is done to emphasise the importance of double plating in management of Scahtzker type V &VI fractures based on **Honkonen Jarvinen criteria (1992).**

AIM OF THE STUDY

AIM OF THE STUDY

The aim of the study is to prospectively analyse the clinical, functional and radiological outcome of high velocity tibial plateau fractures managed by dual plating at Govt. Kilpauk Medical College Hospital between August 2013 and August 2015.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

The management of tibial plateau fractures has improved dramatically for the past 50 years. In the early 1950's these fractures were treated non operatively and many surgeons published favourable results by this management [2].

Apley in his study found that longitudinal traction would control the deformity and knee can be mobilized early [2].

Lasinger et al had an extensive 20 year follow up of patients with non operative management. He concluded that coronal instability of less than 10 degree had favourable outcome [2].

Duwelius and **Conoly** showed that early mobilization of patients managed by closed reduction with or without percutaneous pins had 89 % good clinical outcome [2].

Hence from these studies it is evident that proximal tibia can tolerate modest deformities. However **Sarmiento et al** in his study showed that bicondylar tibial plateau fractures with intact fibula when managed conservatively resulted in varus malalignment on weight bearing[2].

This led to origin of Operative management in tibial plateau fractures in early 1980's.Every Surgeon had his own criteria to operatively treat these fractures. Hence the need for classifying these fractures evolved[2].

Thus **Schatzker's** era (1970's)evolved with his major contribution to classifying tibial plateau fractures which remains central among other classifications.

Surgical treatment has now revolutionised in management of tibial plateau fractures. The goal of treatment as proposed by **Lambotte** being;

1) Restoring articular congruity
2) Axial alignment
3) Joint stability
4) Early Knee motion[3].

Operative treatment includes:

1) Isolated lateral locking plate
2) Dual plating with lateral locking plate and posteromedial buttress plate
3) Hybrid external fixator
4) Ilizarov
5) LISS

Each technique has its own merits and demerits.

The use of Isolated Lateral Locking plate and Dual Plates is still a debate. Patients treated with isolated lateral locking plate had high risk of loss of reduction and increased incidence of malunion[7].

Lasanianos et al showed that collapse of medial tibial plateau occurred in isolated lateral locking plate when he compared the biomechanical properties of intramedullary nail, dual plates and isolated lateral locking plates[8].

While Ilizarov fixation and Hybrid external fixation seems reasonable methods of fixation of these fractures , there are a few problems including the insufficient fracture reduction[9], inconvenience of an external fixator that requires careful maintenance , possibility of pin tract infections , joint capsule penetration with resultant septic arthritis[7], subsequent collapse of fracture fragments[8],and prolonged hospitalisation[5].However they are useful in the treatment of open Scatzker type 5 and 6 tibial plateau fractures[8].

Though LISS (Less Invasive Stablization System) permits in direct fracture reduction, fixed angle construct, percutaneous sub muscular implant, the cost is high and only case series has been published.

Gosling et al reported significant malreduction in 16 of 69 bicondylar fractures treated with LISS [9].

Dual Plating is preferred over other techniques as it has several advantages:

- Better visualisation of fracture fragments, especially posteromedial fragment and articular surface[9].
- Dual incision reduces wound complications[9].
- Both lateral and medial column is fixed to obtain stability[6].
- Achieves interfragmentary compression[7].
- Rigid construct[7].

Tul B Pun et al in his study reported the outcome of 17 tibial lateau fractures. 9 of which were managed by dual plating and 8 managed by hybrid ex fix. Based on Honkonen Jarvinen Criteria all patients could walk, climb stairs, jump, 90% could squat, 50% could duck walk .85% had plateau tilt <5°, 92 % had articular step off < 2 mm. No major infection[8] .

Ebrahim Ghayem Hassankhani et al in his study reported 22 patients with tibial plateau fractures treated with dual plating. The outcome was assessed based on knee society score.86.4 % had excellent, 9.1% had good, 4.5 % had fair and no one showed poor results[5].

G.Thiruvengita Prasad et al in his study reported 40 patients fixed with double plating and based on oxford knee society score 30 patients had excellent and 10 patients had good outcome respectively[6].

Yong Zang et al in his study reported 41 patients fixed with double buttress plate and 38 patients fixed with lateral locking plate and buttress plate. The mean Hospital for Special Surgery Score was 77.9 ± 9.4 and 79 ± 7.9 respectively[9].

Chang Wug Oh et al in his study reported 23 unstable proximal tibia fractures treated with double plating.21 patients had excellent and radiographic results, 1 patient had shortening (1 cm) ,2 cases had mild varus malalignment (<10°), 1 case had superficial infection which improved with implant removal, no deep infection occurred[10].

ANATOMY OF KNEE

JOINT

ANATOMY OF KNEE JOINT

The knee joint is complex hinge joint and largest synovial joint. It consist of partially separated three different components.

Skin

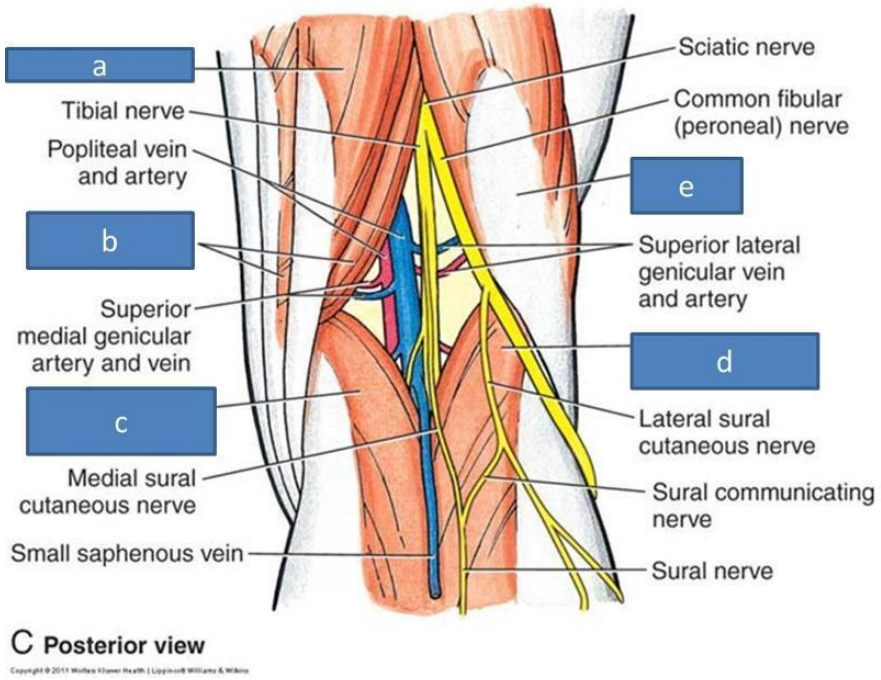
The arterial supply of skin overlying knee is derived from

1) Popliteal artery (Genicular branch)
2) Femoral artery (Descending genicular branch)
3) Anterior tibial artery (Anterior recurrent branch)

Cutaneous veins are tributaries of vessels that correspond to named arteries and lymphatic drainage is to superficial inguinal nodes. Cutaneous nerve supply is mainly infrapatellar branch of Saphenous nerve.

Soft Tissue:

Poplitealfossa is rhomboidal region posterior to knee joint. Boundaries are formed by Biceps femoris (proximolateral), Lateral head of Gastronemics & Plantaris (Distolateral), Semitendinosus and Semimembranosus (Proximomedial), Medialhead of Gastronemics (Distomedial).Short Saphenous vein and Sural Nerve run over popliteal fascia. The contents of the fossa are Popliteal vessels, Tibial and ommon peroneal Nerve.



Bone:

Patella:

The Largest Sesamoid bone embedded in Quadriceps femoris tendon. It is a flat bone with two surfaces; anterior and posterior and three borders; superior, medial, lateral. The quadriceps tendon blends distally with Patellar tendon. The patella tendon is separated from synovium by infrapatellar pad of fat and from tibia by a bursa. The anterior surface is striated while the posterior surface is smooth which articulates with femoral patellar surface and it has seven facets. The arterial supply is from genicular anastomosis.

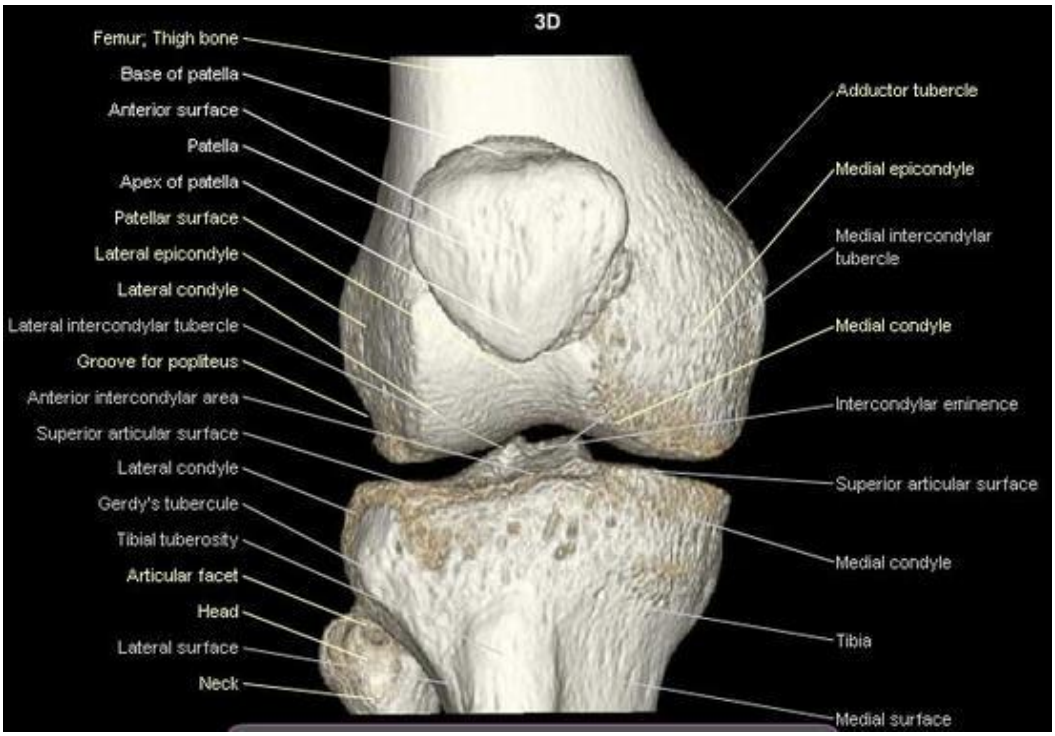
Joint:

Patellofemoral joint:

It is a synovial joint. Patella articulates with anterior surface of both condyles. The femoral articulating surface is asymmetrical sellar surface. In full flexion, highest lateral patellar facet contacts anterior part of lateral condyle. As the knee extends the middle facet articulates and in full extension only the lowest facet in contact with femoral condyle .

Tibiofemoral joint:

It is a complex synovial joint.



Tibial surface:

The proximal tibial articular surface slopes posteriorly relative to long axis of the shaft. The medial proximal tibial articular surface is oval and flat with anterior surface sloping up 10° and posterior surface covered by meniscus making it concave for medial femoral condyle. The lateral proximal tibial articular surface is circular and convex. The posterolateral corner overhangs the shaft where the tendon of popliteus is in contact with the bone. The intercondylar area is narrow in the centre and widened in front and behind. Then arrow centre has the medial and lateral intercondylar tubercle.

Femoral surface:

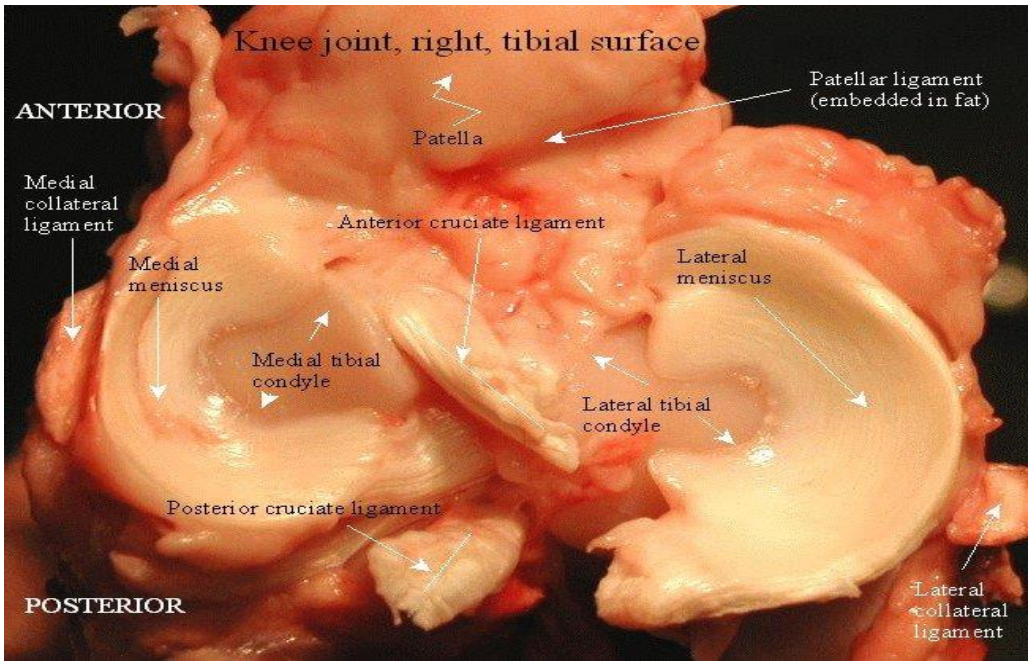
The femoral Condyles bearing the articular cartilage is a closing helix on lateral side and an arc of two circles on medial side.

Menisci:

Tibiofemoral congruence is improved by menisci. These semilunar cartilages have thick peripheral and thin free borders. The peripheral area is vascular and inner aspect is avascular.

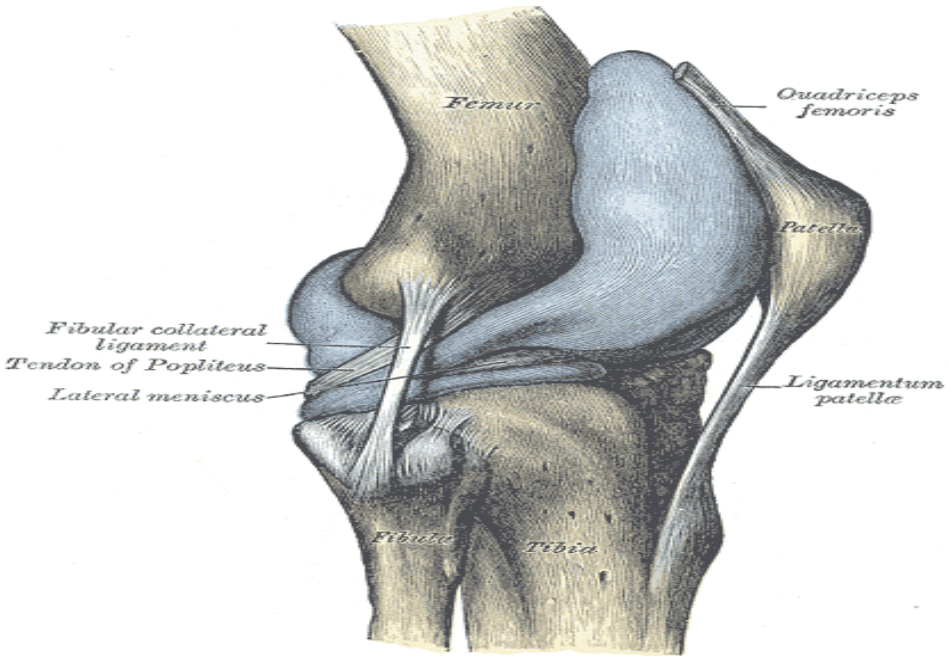
Medial meniscus is semi-circular. Its anterior horn is attached to anterior tibial intercondylar area in front of Anterior cruciate ligament . Posterior horn is attached to posterior intercondylar area between lateral meniscus and Posterior cruciate ligament. Its peripheral border is attached to deep surface of medial collateral ligament.

Lateral meniscus forms 4/5thof acircle. Its anterior horn is attached in front of intercondylar eminence posterolateral to Anterior cruciate Ligament. Its posterior horn is attached behind the eminence in front of posterior horn of medial meniscus. Meniscofemoral ligaments are attached to posterior horn. Intermeniscal ligament connect anterior margin of lateral men is custo anterior horn of medial meniscus.



Capsule:

It is a fibrous membrane of varying thickness. Anteriorly it is replaced by patellar tendon, lies deep to expansion of vastus medialis and lateralis. Posteriorly the capsule consists of vertical fibers arising from femoral condyles, intercondylar notch and proximal tibia.



Medial soft tissue:

Layer 1:

Fascia overlying Sartorius, gracilis, semitendinosus. Fascia overlying gastronemics, medial patellar retinaculum.

Layer 2:

Superficial medial collateral ligament.

Layer 3:

Capsule of knee joint.

Lateral soft tissue:

Layer 1:

Lateral patellar retinaculum

Layer 2:

Lateral collateral ligament, popliteofibular ligament, fabellofibular Ligament and arcuate ligament

Layer 3:

Capsule of knee joint.

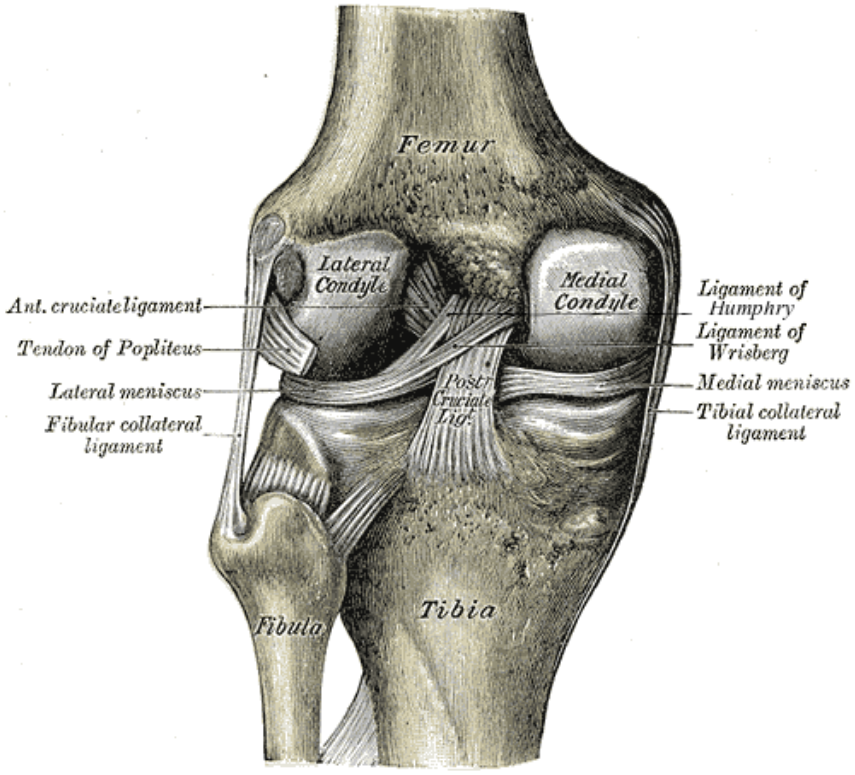
Anterior Cruciate Ligament:

It is attached to anterior intercondylar area just anterior and lateral to medial intercondylar eminence. The fibres ascend posterolaterally and gets

attached to posteromedial aspect of lateral femoral condyl. It consist to anteromedial and posterolateral bundle.

Posterior Cruciate ligament:

It is attached to lateral surface of medial femoral condyle and extends up onto anterior surface of intercondylar notch. The fibers passdistally and posteriorly and attaches in the intercondylar area in a depression in the adjacent posterior tibia. It has anterolateral and posteromedial bundle.



Synovial membrane, Plica:

It is most extensive and complex. It forms suprapatellar bursa and as it moves distally it forms two alar folds which converge to form plica.

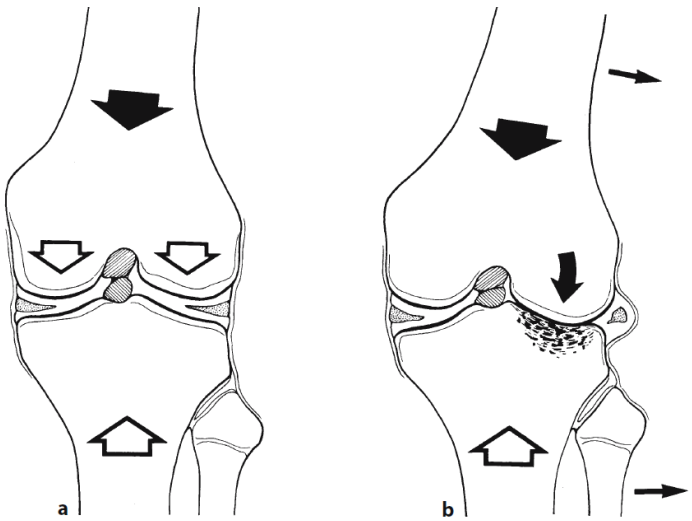
MECHANISM OF INJURY

MECHANISM OF INJURY

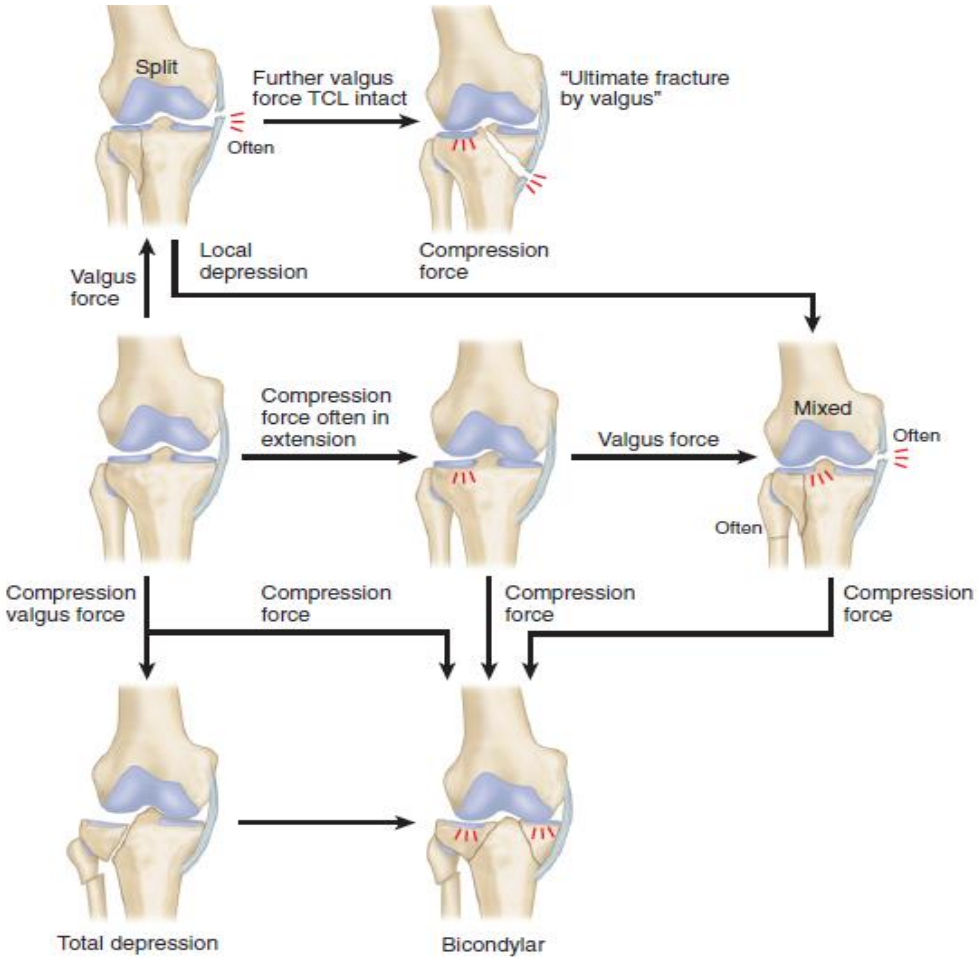
Tibial Plateau fractures occur due to **vertical thrust** and **bending forces (Kennedy& Bailey 1968)**.This mechanism of fracture leads to varying degrees of articular surface depression[1].

The Split wedge fragments are produced by vertical thrust forces which separate weight bearing surface from subjacent bone.If this displaced fragment is accompanied by joint depression axial malalignment occurs[1].

Axial malalignment and articular depression shift the weight bearing axis to the side of depression and this overload will lead on to future post traumatic arthritis. This enhances the role of congruous articular reduction during fixing these fractures[1].



In addition to fracture, the ligaments such as cruciates and collaterals may give away and produce joint instability**(Roberts 1968 ; Rasmussen 1973; Holh and Hopp 1976 ; Schatzker et al 1979; Holh and Moore 1983).** The Joint instability is also responsible for post traumatic arthritis. It introduces shearing forces and these may destroy the articular cartilage. The ligament instability is dealt as secondary procedure based on its severity.



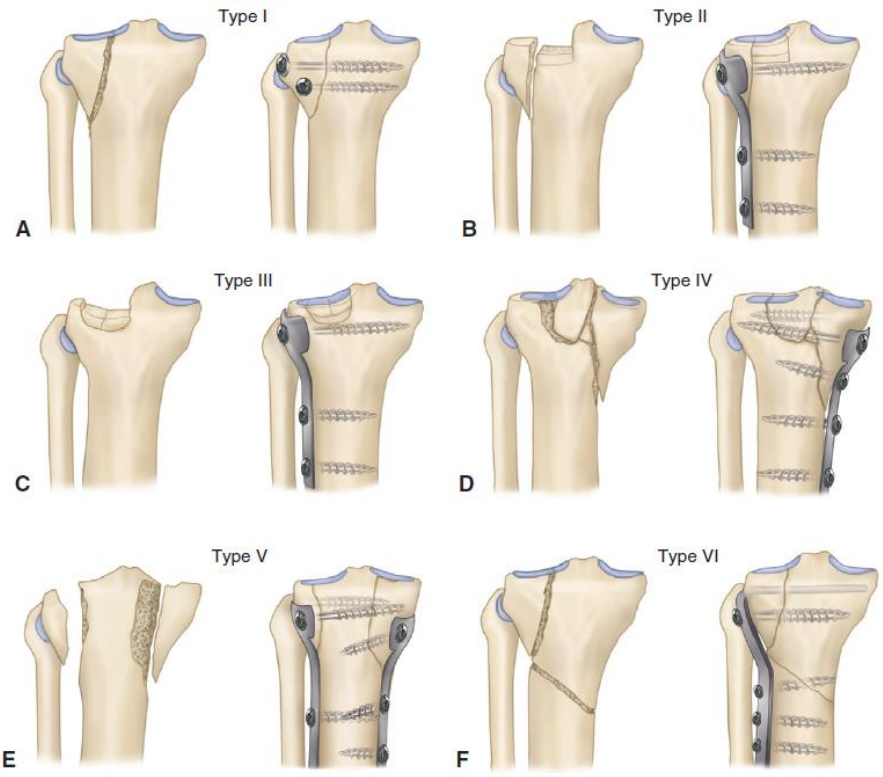
Shulak and Gunn's Hypothesis

CLASSIFICATION

CLASSIFICATION

Several classifications have been developed to classify tibial plateau fractures with Scatzker's classification being the cornerstone of all.

Scatzker's Classification:



Type 1: Purecleavage. A wedge shaped fragment is split off and displaced laterally and it commonly occurs in younger patients.

Type 2 : Cleavage combined with depression. Along with lateral split wedge fragment articular surface is depressed into metaphysis. It commonly occurs in older individuals.

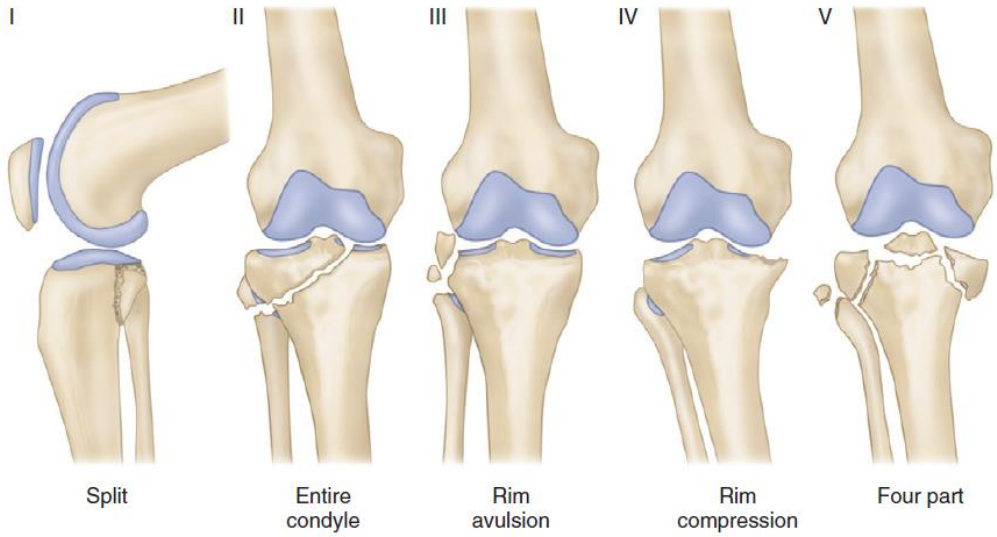
Type 3: Pure central depression. Articular depression alone occurs with intact lateral cortex and it occurs in osteoporotic individuals.

Type 4 : Fracture of medial condyle. Often the tibial spines are involved. The fragments may be wedge or comminuted.

Type 5 : Bicondylar fractures. Both the tibial plateaus are split. The metaphysis and diaphys is retain the continuity. Both condyles can be fixed with buttress plate and cancellous screws.

Type 6 : Plateau fracture with dissociation of metaphysis and diaphysis. Additionally transverse or oblique fracture of proximal tibia is present. These factures should be treated with buttress plate and cancellous screws one on either side if both condyles are fractured.

Holh and Moore classification:(Fracture dislocation classification)



Type I : Coronal split fracture. Medial side is involved and the fracture line runs at 45° to medial plateau in oblique coronal transverse plane.

Type II : Entire condyle fracture. Either medial or lateral tibial plateau is involved and fracture line extends into opposite condyle beneath intercondylar eminence. The opposite collateral ligament is involved in half of the fractures.

Type III : Rim Avulsion fracture. This type involves the entire lateral plateau with avulsion fragments of capsular attachment, tubercle of gerdy, or the plateau. Disruption of either or both cruciate ligaments is common.

Type IV: Rim compression fracture. This unstable fracture has opposite collaterals and cruciate avulsed and allowing tibia to subluxate

to such an extent that femoral condyles compress portion of anterior, middle and posterior rim.

Type V: Four part fracture. Neurovascular injury occurs in 50% of fractures. This unstable bicondylar fracture has both collaterals disrupted with separate intercondylar eminence fragment.

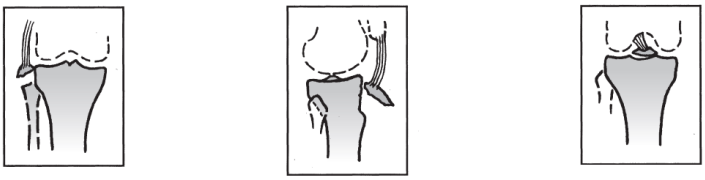
AO/OTA Classification:

Subgroups and qualifications:

Tibia/fibula, proximal, extra-articular, avulsion (41-A1)

1. Of fibular head (41-A1.1)
2. Of tibial tuberosity (41-A1.2)
3. Of cruciate insertion (41-A1.3)
   (1) anterior
   (2) posterior

A1



Tibia/fibula, proximal, extra-articular, simple metaphysis (41-A2)

1. Oblique in frontal plane (41-A2.1)
2. Oblique in sagittal plane (41-A2.2)
3. Transverse (41-A2.3)

A2

Tibia/fibula, proximal, extra-articular, multifragmentary metaphysis (41-A3)

1. Intact wedge (41-A3.1)
   (1) lateral
   (2) medial
2. Fragmented wedge (41-A3.2)
   (1) lateral
   (2) medial
3. Complex (41-A3.3)
   (1) slightly displaced
   (2) significantly displaced

A3

Tibia/fibula, proximal, partial articular, split (41-B1)

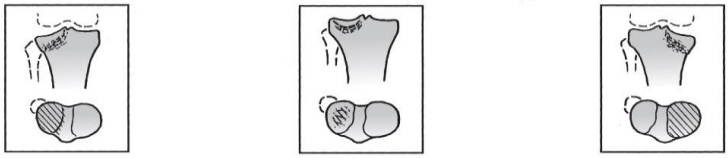
1. Of lateral surface (41-B1.1)
   (1) marginal
   (2) sagittal
   (3) frontal anterior
   (4) frontal posterior
2. Of medial surface (41-B1.2)
   (1) marginal
   (2) sagittal
   (3) frontal anterior
   (4) frontal posterior
3. Oblique, involving the tibial spines and 1 of the surfaces (41-B1.3)
   (1) lateral
   (2) medial

B1

Tibia/fibula, proximal, partial articular, depression (41-B2)

1. Lateral total (41-B2.1)
   (1) 1 piece
   (2) mosaic-like
2. Lateral limited (41-B2.2)
   (1) peripheral
   (2) central
   (3) anterior
   (4) posterior
3. Medial (41-B2.3)
   (1) central
   (2) anterior
   (3) posterior
   (4) total

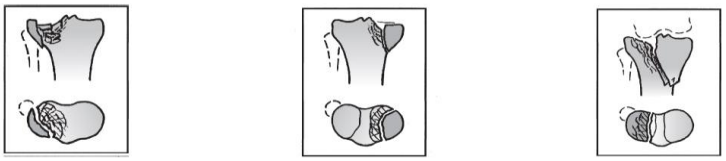
B2

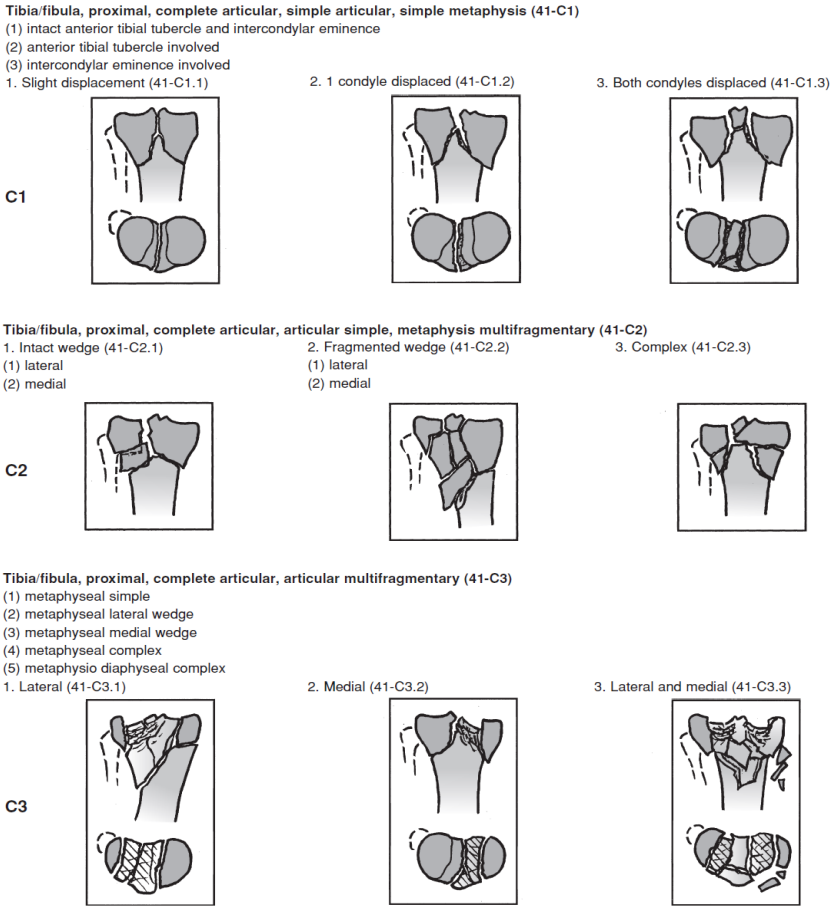


Tibia/fibula, proximal, partial articular, split depression (41-B3)

1. Lateral (41-B3.1)
   (1) antero lateral depression
   (2) postero lateral depression
   (3) antero medial depression
   (4) postero medial depression
2. Medial (41-B3.2)
   (1) antero lateral depression
   (2) postero lateral depression
   (3) antero medial depression
   (4) postero medial depression
3. Oblique involving the tibial spines and 1 of the surfaces (41-B3.3)
   (1) lateral
   (2) medial

B3





The AO/OTA classification distinguishes range of severity in high energy patterns. It is well accepted for trauma databases and has been used in recent publication on tibial plateau fractures. It is increasingly becoming standard and well accepted way to classify proximal tibial fractures.

In this classification Tibia is 4 and proximal tibia is 1. So tibial plateau is 41. The rule of squares is used to distinguish these fractures from tibial shaft fractures 42.

Type A : These are non-articular fractures of proximal tibia. Technically they are not tibial plateau fractures, since the articular surface is not involved.

Type B:Partial articular fractures.

B1 – Simple articular split

B2 – Split depression

B3 – Comminuted split depression

Type C:Complex articular fractures.

C1 – Non comminuted total articular fracture.

C2 – Metaphyseal comminution with simple articular fracture lines.

C3 – Total comminuted articular fractures including the articular surface.

DIAGNOSIS

DIAGNOSIS:

History:

The history starts with mode of injury. Low energy injuries arise from sports injuries or falls, particularly in elderly individuals .Hence chances of neurovascular deficit is low in these modes of injury.

Whereas injuries resulting from Motor vehicle accidents, Fall from height and Pedestrian struck injuries are high velocity injuries and are usually associated neurovascular deficit and compartment syndrome.

The fracture pattern gives a clue to identify the mode of injury and it determines the risk of complications.

Examination:

The need for examination is to identify associated injuries, to plan for operative management and the decide the time which is optimal for intervention.

A thorough neurological and vascular examination is necessary in all injured limbs and especially in fractures where there is metaphyseal diaphyseal dissociation.

The compartments of leg have to be monitored by serial measurements and a suspicion of compartment syndrome should alarm the surgeon for fasciotomy. The alarming signs are tense compartment and pain on passive stretching.

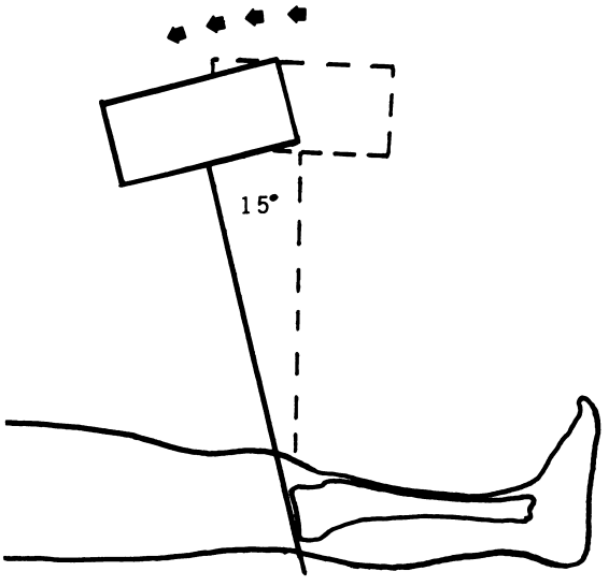
These fractures may have open wounds communicating with fracture. Most often soft tissue around proximal tibia is injured and the timing of surgery is planned according to soft tissue healing. Signs such as swelling, contusion and fracture blisters has to be looked for. In these injuries Coronal plane instability is difficult to be examined as patient will have pain on examination. But if present these fractures will be displaced and the fracture will not heal unless reduced .

Imaging:

X-ray:

The standard anteroposterior and lateral radiographs are taken to assess tibial plateau fractures. Special view such as 10-15 degree caudal view best visualizes tibial plateau

ANTEROPOSTERIOR VIEW **LATERAL VIEW**



Tibial Plateau view (10-15° caudal)

Sometimes oblique images are taken to assess the fracture. In Type 5 and 6 fractures traction xrays are taken to better assess fracture anatomy.

Insevere fracture, radiographs obtained after applying joint spanning external fixator (by avoiding metal bars or clamps overlying proximal tibia) will provide necessary traction for assessment of fracture anatomy.

Computed Tomography scan:

The pathoanatomy is best provided by axial cuts in CT and it is important as a tool in aiding preoperative planning for operative approach and fixation methods.

The advantages are articular displacement and comminution are clearly demonstrated, helpful in classifying fractures. CT was found to be sensitive and specific small bony avulsions. 3D CT is being increasingly used to demonstrate spatial relationship of fracture fragments.

Current multi directional row CT provides CT data sets of fractured plateau that may be visualized in any two dimensional plane or with high quality.

Magnetic Resonance Imaging:

MRI is the imaging modality of choice in proximal tibia stress fracture. Also soft tissue injuries such as meniscus and ligament injuries are identified by MRI. For evaluating tibial plateau fracture MRI is still debated.

PRINCIPLES OF

TREATMENT

PRINCIPLE OF TREATMENT

Nonoperative management:

The proximal tibial articular surface tolerates small to modest articular displacements and in properly selected fractures non operative treatment results in predictably excellent outcome despite articular irregularities.

Non operative treatment is therefore indicated for:

1) Tibial plateau fractures that will heal without significant deformity.
2) Elderly patients.
3) Patients associated with medical problems where operative intervention is high risk.
4) Patients where deformity will be clinically acceptable.

Predicting healing without deformity is difficult. To make this judgement, the surgeon must have the knowledge of various types of fracture and the alignment both on injury radiographs and on clinical examination.

Localised depression of upto 2 millimetres of lateral tibial plateau may result in stable knees and good outcome when treated non operatively.

Depression with associated split fragments will more likely lead to valgus malalignment.

The medial articular surface is less well protected by meniscus. A minimally displaced medial condyle fracture has great potential for displacement that may lead to unacceptable varus deformity. Hence nonoperative treatment for bicondylar and proximal metadiaphy seal Dissociation is unsuccessful.

Operative management:

Operative treatment is indicated for:

1) Displaced unstable tibial plateau fractures where near normal limb alignment cannot be predicted based on fracture pattern or physical examination .
2) All bicondylar & shaft dissociated patterns
3) All but minimally displaced medial &lateral tibial plateau facture patterns where valgus malalignment will occur without surgically reducing and fixing the fracture .
4) For lateral patterns ; split fragment, depression affecting over half of lateral articular surface, fibula head fracture, valgus alignment on injury radiograph, clinical valgus alignment on examination .

5) Open fractures
6) Associated Neurovascular injury.

The ultimate goal of operative fracture fixation is to obtain full restoration of function of injured limb and the patient to return to preinjury status of activities as well as to minimise the risk and incidence of complications.

The choice is between internal and external fixation with proponents for each.

Principles of Plates and screw fixation of Tibial plateau fractures:

Plates and screws are most frequent implants used to stabilize Tibial plateau fractures. The simplest implants such as 6.5mm cancellous screws either in isolation or in conjunction with other fixation devices, work well with major plateau fracture lines.

Plate serve different function depending on fracture pattern. Commonly they are applied on anterolateral proximal tibia where it is used as a buttress. 3.5 mm implants and screws are the most common size as they are less bulky, allow more screws to be placed near the articular surface to support reduced fragments and minimise post-operative settling **(rafting screws)**.

Posteromedial plate serves as an **antiglide device** to resist shearing force. The plate position in relation to apex of fracture is more important and the screw near the apex will assure close apposition of plate in this area.

Precontoured plates reduce the time spent for intraoperative contouring, limits approach when bone is not completely visualised to allow contouring , may assist in reduction by fitting the fracture bone to precontoured plate.

Locking screws to plates has been a big advantage of resisting axial, rotational and bending forces. Limited approach is required.

Hybrid techniques with the use of nonlocked screws to pull the bone to precontoured plate and then locked screws are added to resist angular deviation.

Principles of External fixation of Tibial plateau fractures:

External fixation is used as initial temporary treatment by spanning the knee. It restores length and aligns the fracture during soft tissue recovery prior to definitive treatment with internal fixation. In cases of open fracture External fixator serves as definitive treatment.

The pin should be placed such that they do not interfere with subsequent procedures of internal fixation , keeping contaminated pin sites away from future incision. Radiolucent carbonbar facilitate imaging after the frame is applied.

Widely displaced fractures with tense swelling , fracture blisters, open wounds are indication of temporary external fixator. Staged protocol reduces wound complication rate where Damage Control Orthopaedics come into play.

MATERIALS AND METHODS

MATERIALS AND METHODS

Our study is a prospective study conducted at Department of Orthopaedics, Govt. Kilpauk Medical College Hospital between August 2013 and August 2015.

Inclusion Criteria:

Patients with High velocity tibial plateau fractures who are,

1) Skeletally mature & age between20 – 60 years.
2) Included in the criteria of depression / displacement of articular surface of >2 mm
3) Included in Schatzker's Classification of tibial plateau fractures Type V &VI.

Exclusion Criteria:

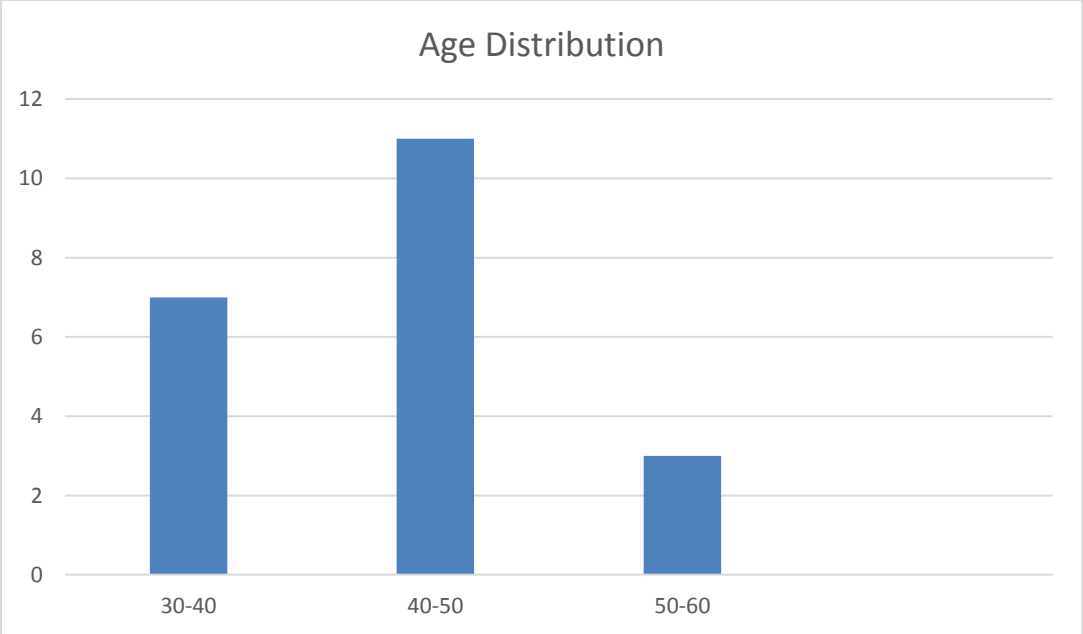
Patients with

1) Open fractures
2) Pathological fractures
3) Associated pre-existing joint disease (osteoarthritis)
4) Associated Neurovascular injury / head injury
5) Skeletally immature patients.

Twenty one patients were included in the study who satisfied these criteria.

Age Distribution:

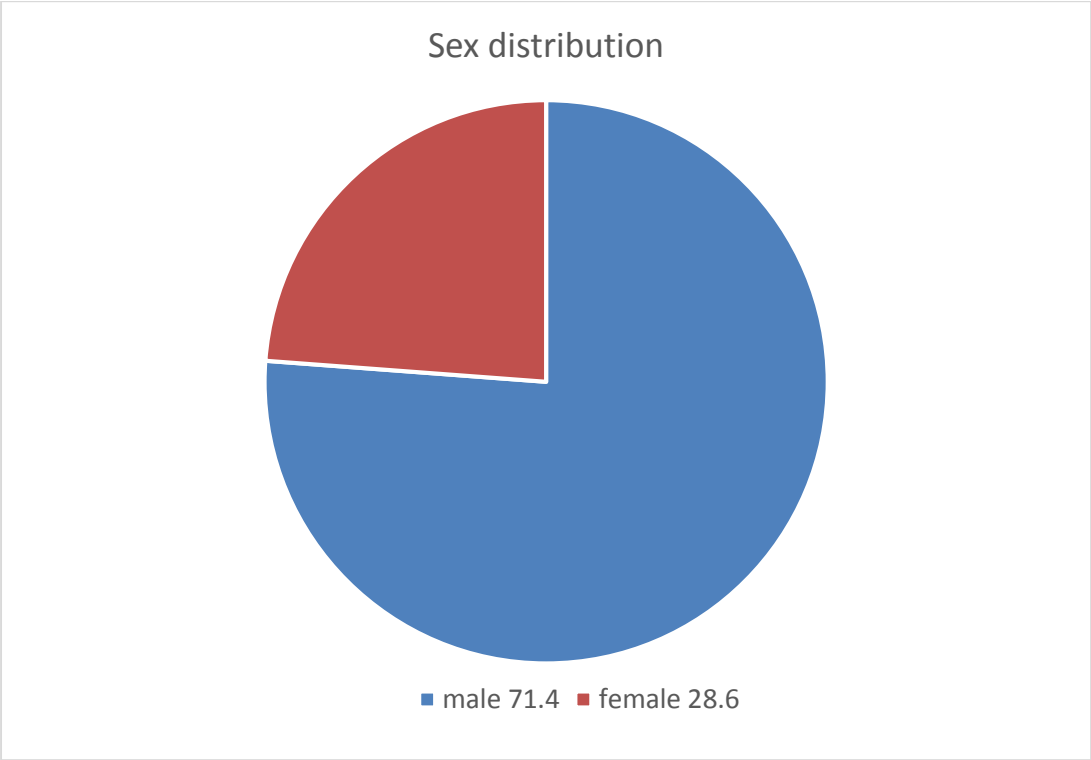
Age	Number	Percentage
30-40	7	33.3
40-50	11	52.4
50-60	3	14.3



Sex Distribution:

Male : 16

Female : 5



Mode of Injury:

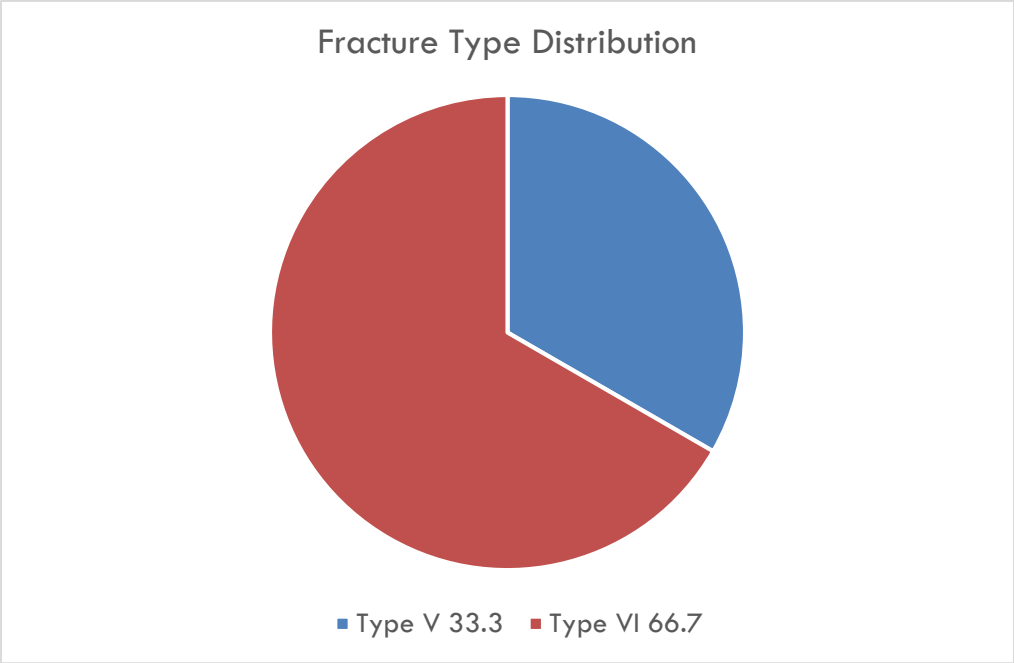
All21 sustained Road traffic accident.

Side of Injury:

Side	Number	Percentage
Right	9	42.9
Left	12	57.1

Fracture Types:

Fracture type	Number	Percentage
Type V	7	33.3
Type VI	14	66.7



Time of surgery:

The average period from day of injury to surgery was **5.3 days** with a range between 3 to 9 days.

MANAGEMENT

PROTOCOL

MANAGEMENT PROTOCOL

Pre – operative management:

Patients were received in the casuality and initially stabilised to achieve adequate haemostasis. Then intramuscular analgesics were given. The injured lower limb was immobilised in a Above Knee Splint and Anteroposterior , Lateral, Oblique Xrays (if required) were taken.

Then with minimal traction a Above Knee Slab was applied. Distally the slab was slit open for checking distal pulses. Three Dimension Computed Tomography was done to assess the fracture pattern.

If Required Calcaneal pin traction was applied for soft tissue injury to heal. Adequate time was given for soft tissue to heal around (5–14days). Clinical signs of soft tissue recovery included **decreased swelling, absence of fracture blisters, Wrinkling of skin** around proximal tibia.

Surgical procedure:

Preoperatively iv antibiotics were given after test dose as routine prophylaxis.

The patient in supine position with folded pillow under knee and a sand bag under ipsilateral gluteal region for anterolateral approach and a

sand bag under contralateral hip with figure of four position of ipsilateral leg for posteromedial approach. Femoral distractor if needed was used. First indirect fracture reduction was achieved with longitudinal traction, under Carm guidance. Percutaneous K wires were used to hold the fragments in reduction. We typically fix medial tibial condyle first. If medial condyl is comminuted we fix lateral condyl to achieve length.

Through posteromedial approach to proximal tibia with approximately 6cm incision over posteromedial border of proximal tibia. After opening subcutaneous fat, the long saphenous vein and saphenous nerve identified and preserved. Pes anserinus expansions identified. Tibia approached after incising pes anserinus longitudinally in the line of skin incision. The gastronemics musclewas gently freed from posteromedial surface by blunt dissection.

The fracture fragments visualised, reduced under c arm guidance. If there was articular depression a bone punch was used to elevate the depressed portion and the void was filled with bone graft .The reduced fragments were fixed with 3.5 mm proximal tibia Tor L Buttress Plate Or Recon Plate or Semi tubular plate and screws, after contouring .

The lateral condyle fracture was approached antero laterally. “S” shaped incision was made starting 5 cm proximal to joint line curving the

incision anteriorly over gerdy's tubercle and extend it distally 1cm lateral to anterior border of tibia. Joint capsule was incised. Tibialis anterior was elevated by blunt dissection.

Under C arm guidance, fracture reduced and fixed with Proximal Tibia Lateral Locking Compression Plate. If depression was present in articular surface, elevation followed by bone grafting was done.

A drain was kept for both wounds with help of Y connector.

Post-OperativeProtocol:

Well-padded sterile dressing was done. Knee was not immobilised. Drain was removed on 2nd Post-operative day. Active knee mobilisation was encouraged as much as the patient could tolerate .Suture removal was done on 12th Post-operative day. Patient was discharged with Non weight bearing crutch walking.

Follow Up:

Patient was reviewed in Out Patient Department every 4 weeks and X rays were taken every month for first 6 months to assess union Partial weight bearing was started after 8 weeks. Full weight bearing was allowed after radiological evidence of bony union was achieved . After 6 months patients were reviewed every3 months.

Assessment:

The Clinical, Functional and Radiological assessment was done based on Honkonen Jarvinen Criteria(1992).

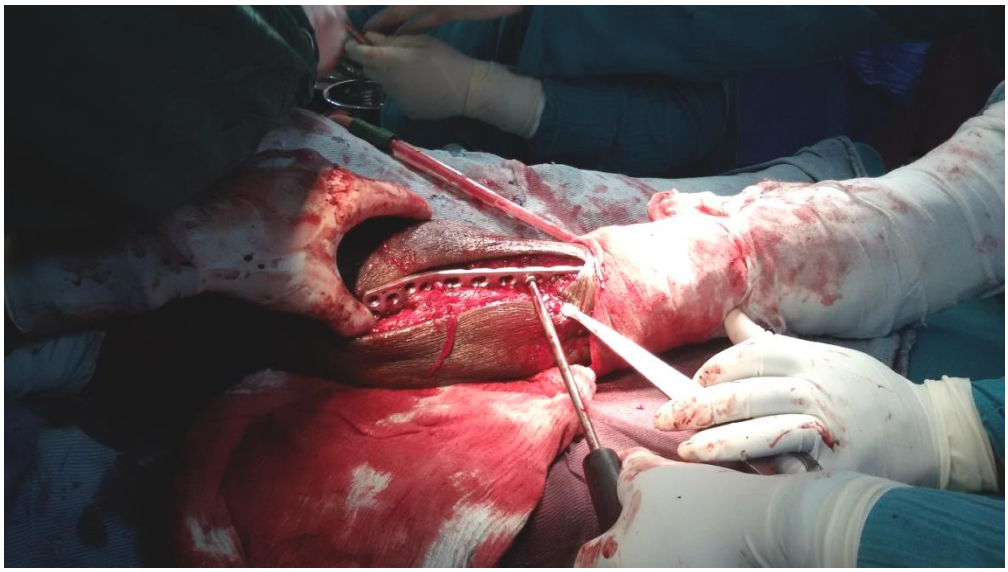
Our patients had average follow up for **15.7** months ranging from9 to 22 months.

Intraoperative pictures:

SURGICAL INSTRUMENTS :

POSTEROMEDIAL PLATING

ANTEROLATERAL PLATING



INTRAOPERATIVE FLUOROSCOPY

HONKONEN JARVINENCRITERIA:(1992)

CLINICAL OUTCOME CRITERIA:

1.	**Extension lag (degrees)**	1	None	
		2	1 – 5	
		3	6 – 10	
		4	> 10	
2.	**Flexion Range (degrees)**	1	> 130◦	
		2	110 - 129◦	
		3	90 -109◦	
		4	> 90◦	
3.	**Thigh Atrophy (cm)**	1	None	
		2	> 0 to 1	
		3	> 1 to 3	
		4	> 3	
4.	**Stability**	1	Normal	
		2	Mediolateral	Stable in extension
				5° to 10° instability in flexion
			Anteroposterior – Grade 1 instability (Lachman or Drawer test)	
		3	Mediolateral – 5° to 10° instability in extension.	
			Anteroposterior – Grade 2 instability	
		4	Mediolateral - >10° instability	
			Anteroposterior – grade 3 instability	

FUNCTIONAL OUTCOMECRITERIA:

	Walk	1	Normal
		2	Slight limp
		3	Severe limp or stick
		4	Wheel chair
2.	**Stair Climbing**	1	Normal
		2	Impaired
		3	One at a time
		4	Unable
3.	**Squatting**	1	Normal
		2	Impaired
		3	$< 90^{\circ}$
		4	Unable
4.	**Jumping**	1	Normal
		2	Impaired
		3	Only with aid of uninjured leg
		4	Unable
5.	**Duck walk**	1	Normal
		2	A few steps
		3	One step
		4	Unable

RADIOLOGICAL OUTCOME CRITERIA:

1.	**Plateau tilting (degrees)**	1	None
		2	1 - 5
		3	6 - 10
		4	> 10
2.	**Varus/Valgus tilt (degrees)**	1	none
		2	1 - 5
		3	6 - 10
		4	> 10
3.	**Articular step off (mm)**	1	none
		2	1 - 3
		3	4 - 6
		4	> 6
4.	**Condylar widening (mm)**	1	none
		2	1 - 5
		3	6 - 10
		4	> 10
5.	**Degeneration (relative narrowing of joint space)**	1	None
		2	< 50 %
		3	> 50 %
		4	obliterated

1: Excellent 2: Good 3: Fair 4: Poor

RESULTS AND ANALYSIS

RESULT:

- The incidence of male was more compared to females in the ratio - 3.2 : 1.
- The nature of injury is high velocity injury as it is explained by all patient sustaining road traffic accident .None had sustained injury as a result of trivial trauma as occurs in elderly with osteoporotic bone.
- The incidence of fracture in right side was 42.9 % and in left side was 57.1 % which nearly equal.
- Among 21 cases, the incidence of fracture in age group 40 -50 was 52.4 %
- Of 21 fractures , 7 patients (33.3 %) had Type V fracture and 14 patients (66.7 %) had Type VI fracture.
- There were no associated injury in all patients
- All patients underwent standard surgical procedure by anterolateral & posteromedial approach .
- Lateral locking plates were used for lateral plateau and T/L Buttress, Semi tubular, Recon plates were used for medial plateau.
- Bone Grafting was used for 9 patients (42.9%) to fill metaphy seal defect.

- Time required for union ranged from 11 to 16 weeks with average being **12.9** weeks.

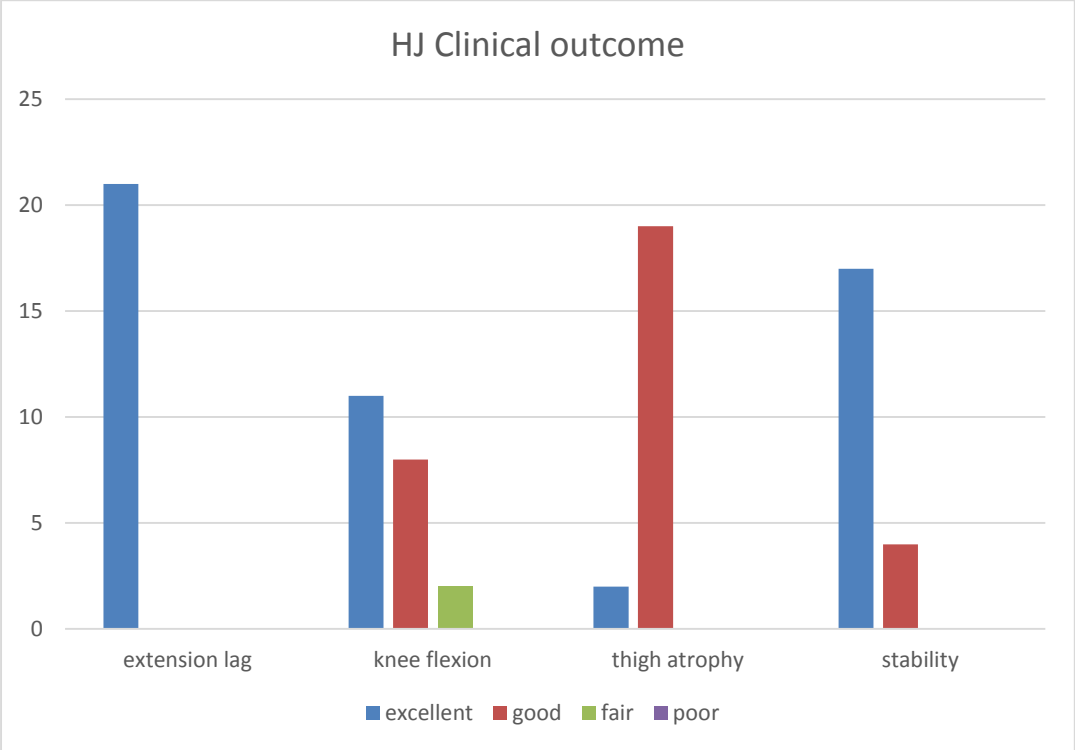
RESULT ANALYSIS

Honkonen Jarvinen Criteria was used for evaluating Clinical, Functional and Radiographic results.

HJ Clinical Outcome:

Criteria	excellent	Good	fair	poor
Extension lag	21(100 %)	-	-	-
Knee flexion	11 (52.3%)	8 (38.1%)	2 (9.5%)	-
Thigh atrophy	19 (90.5%)	2 (9.5%)	-	-
Instability	17 (81%)	4 (19%)	-	-
Mean %	81%	16.6%	2.4%	

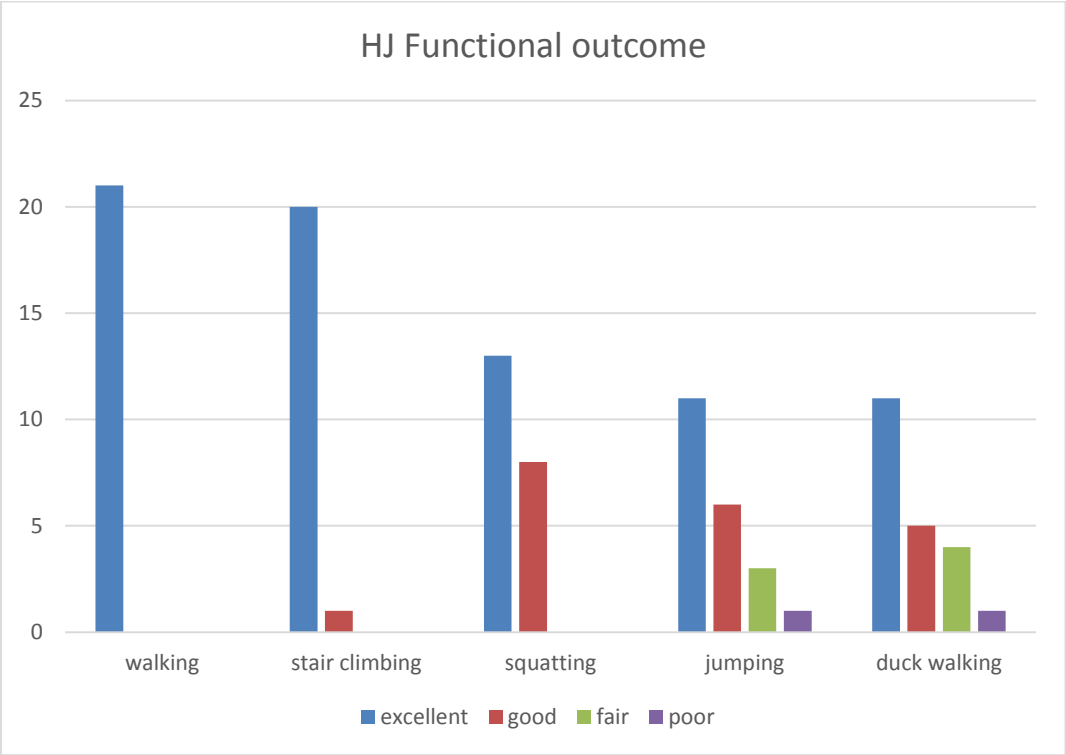
- None of the patients had extension lag.
- The average knee flexion was 125.9° with range from 95° to 135°. The reason for fair range of motion in two patients was poor adherence to physiotherapy.
- The average thigh atrophy was 0.09 cm with range from 0 – 1 cm.
- There was grade1 antero posterior instability in 4patients.



HJ Functional outcome:

Criteria	excellent	good	fair	poor
Walking	21 (100%)	-	-	-
Stair climbing	20 (95%)	1 (4.8%)	-	-
Squatting	13 (61.9%)	8 (38.1%)	-	-
Jumping	11 (52.4%)	6 (28.6%)	3 (14.3%)	1 (4.8%)
Duck walking	11 (52.4%)	5 (23.8%)	4 (19%)	1 (4.8%)
Mean %	72.3%	19.1%	6.7%	1.9%

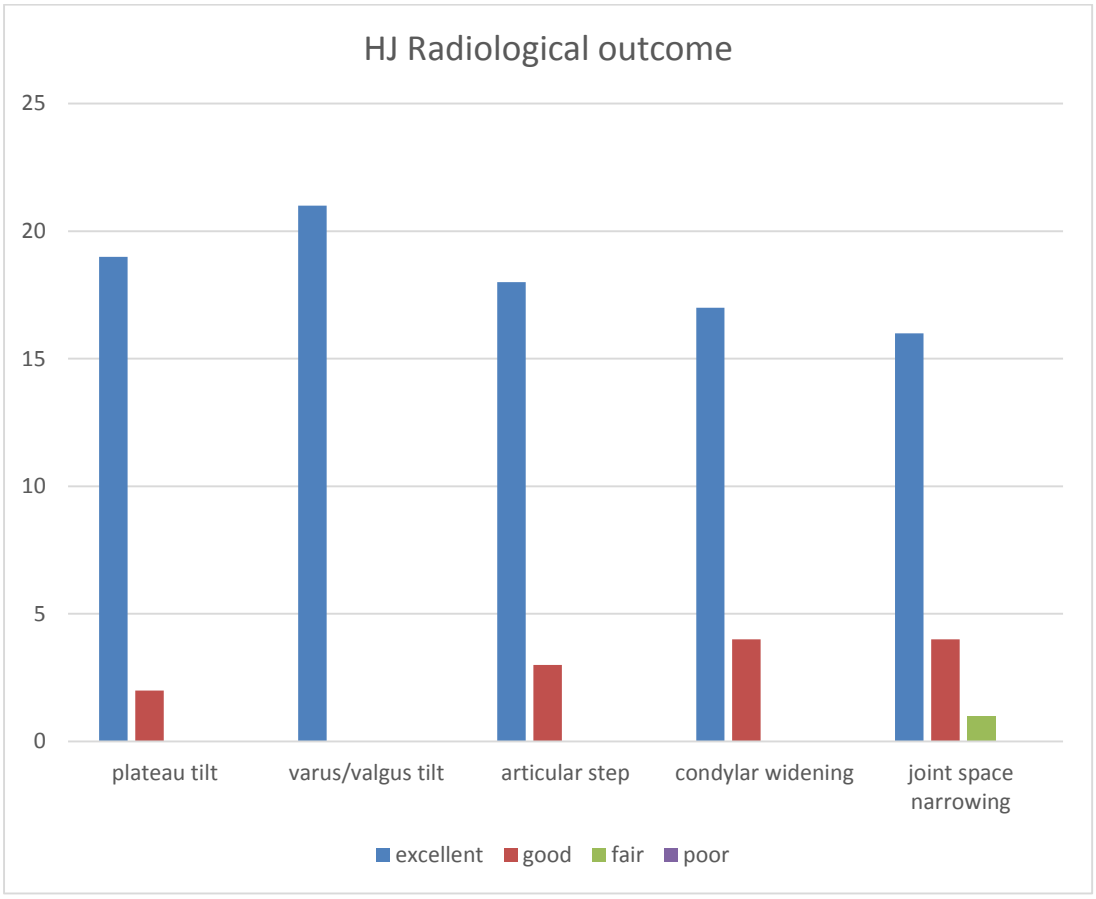
- All 21 patients were able to walk excellent.
- 20 patients had excellent stair climbing function but it was impaired in 1 patient due to pain.
- 13 patient were able to squat well while it was impaired in 8 patients due to pain.
- 11 patients were able to jump normally and it was impaired due to pain in 6 patients. 3 patients were able to jump only with the aid of uninjured leg. 1 patient was not able to jump.
- 11 patients were able to duck walk normally and 5 patients were able to keep only a few steps. 4 patients were able to keep only one step .1patient was unable to do.



HJ Radiological outcome:

Criteria	excellent	good	fair	Poor
Plateau tilt	19(90.5%)	2(9.5%)	-	-
Varus / valgus tilt	21(100%)	-	-	-
Articular step off	18(85.7%)	3(14.3%)	-	-
Condylar widening	17(81%)	4(19%)	-	-
Joint space narrowing	16(76.2%)	4(19%)	1 (4.8%)	-
Mean %	87%	12%	1%	-

- 19 patients scored excellent and 2 patients had scored good with < 5° plateau tilt compared to opposite side.
- All 21 patients had excellent results with no varus / valgus tilt.
- 18 patients did not have any articular step off .3 patients had 1-3 mm articular step.
- 17 patients had no condylar widening. 4 patients had condylar widening of 1-5mm.
- 16 patients did not have any joint space narrowing, 4 patients had <50% joint space narrowing, 1 patient had >50 % joint space narrowing.


HJ Radiological outcome
25
20
15
10
5
0
plateau tilt
varus/valgus tilt
articular step
condylar widening
joint space narrowing
excellent
good
fair
poor

Complications :

- 3 patients had superficial infection which improved with wound debridement, sterile dressing and intravenous antibiotics.
- 2 patients had knee flexion of< 100° which was due to poor physiotherapy.
- 1 patient had implant prominence of 4mm cancellous screw which was removed and revised with another screw.
- 4 patients had occasional pain which was managed with analgesics

Knee Stiffness

DISCUSSION

DISCUSSION

Complex tibial plateau fractures still remain a challenge to most Orthopaedic surgeons. Road traffic accident being the commonest mode of injury leading to these high velocity fractures. To reconstruct a stable painless mobile knee is a tough task and requires expertise and sufficient technical knowledge.

Historically due to poor technique of fixation with dual plates with single midline incision or Mercedes Benz incision, alternate methods of fixation with Ilizarov ring fixation hybrid external fixation were being employed.

Single incision technique had high incidence of wound breakdown and infection . [6]

With the advent of isolated lateral plating with locking compression plate the spectrum has shifted towards locking plate with medial fragment being stabilised by screws passed through lateral plate. Varus collapse in these patients raised the question of its sustainability and the reason found to be inade quate fixation of posteromedial fragment. This has paved way for dual plating via two incision technique.

A double incision Double plating technique is recommended by the Association for Osteosynthesis/Association for the Study of Internal Fixation for the treatment of complex tibial plateau fractures[9]

Locking plates provide fixed angle stability and we hypothesised that using lateral locking plates instead of buttress plate may help to prevent Secondary loss of reduction and alignment. If secondary loss of reduction occurs, osteoarthritis will occur even if primary was satisfactory[8]

In our study, males outnumbered females in the ratio 3.2 : 1 .This is explained by more active life style of males and higher chance of road traffic accidents. This is in accordance with the series of 14 patients reported by **Eggli et al** , in which 10 were male and 4 were female[11].

All 21 patients sustained road traffic accident. Distribution of incidence between sides were near equal. We had 7 schatzker Type V & 14 schatzker Type VI with preponderance of the latter.

Our study reported Honkonen Jarvinen Clinical outcome to be 81% excellent, 16.6% good and 2.4% fair.The functional outcome was 71.3 % excellent, 19.1 % good , 6.7 % fair and 1.9 % poor. The Radiological outcome showed 87 % excellent, 12 % good, 1 % fair results.

As this is a short term study, the results may also vary with further follow up.

Bone grafts were used in 9 (42.9 %) of 21 patients after elevation of depressed articular surface. The mean time of union was 12. 9weeks ranging from11to16weeks.Bone grafting did not contribute to faster healing as metaphyseal defects heal well without bone grafts. In the report published by **Eggli et al** bone grafting was employed in 11 of 14 patients[11].

Knee flexion of 95° and 100° was noted in two patients and physiotherapy was encouraged. Superficial infection occurred in 3 patients and healed with debridement, wound dressing and intravenous antibiotics. Occasional pain in 4 patients was managed with analgesics.

There were no associated injuries in our patients.

CONCLUSION

CONCLUSION

From our study we conclude that,

- High velocity tibial plateau fracture have excellent to good clinical, functional and radiological outcome .
- Early mobilisation of the joint provides good range of motion .
- Posteromedial plating provides a buttress to posteromedial fragment and thereby prevents varus collapse.
- The patients with good soft tissue cover should undergo anatomical reduction and rigid fixation immediately without deferring time.
- This is a short term study and need follow up to predict the further outcome.

CASE ILLUSTRATION

CASE ILLUSTRATION

CASE - 1

Patient Name	:	Mohana
Age	:	30 yrs
Sex	:	Female
Mode of Injury	:	Road Traffic Accident
Side of Injury	:	Left side
Type of fracture	:	Type VI Schatzker
Time interval between injury and surgery	:	3days
Procedure	:	ORIF with Lateral Locking plate and Posteromedial L buttress plate
Post-Operative period	:	Uneventful
Knee Mobilization	:	3rd day
Partial weight bearing	:	8th week
Full weight bearing	:	12th week
Follow up	:	22 months
HJ clinical outcome	:	Good
HJ functional outcome	:	Good
HJ radiological outcome	:	Good

PRE OP

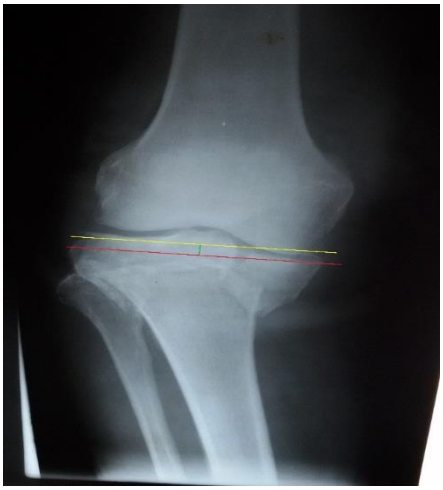
IMMEDIATE POST OP

22 MONTHS POST OP

RANGE OF MOVEMENTS

CASE - 2

Patient Name	:	Gopal
Age	:	60 yrs.
Sex	:	Male
Mode of Injury	:	Road traffic accident
Side of Injury	:	Right
Type of Fracture	:	Type V Schatzker
Time Interval between		
Injury and surgery	:	8 days
Procedure	:	ORIF with Lateral Locking and Posteromedial recon plate
Post Op Period	:	Uneventful
Knee Mobilization	:	3rd day
Partial weight bearing	:	12thweek
Full weight bearing	:	16thweek
Follow up	:	18 months
HJ clinical outcome	:	Good
HJ functional outcome	:	Good
HJ radiological outcome	:	Good



PRE OP

IMMEDIATE POST OP

18 MONTHS POST OP

RANGE OF MOVEMENTS

CASE – 3

Patient name	:	Sivanandhan
Age	:	45yrs.
Sex	:	Male
Mode of injury	:	Road Traffic Accident
Side of injury	:	Left
Typeof Fracture	:	Type V
Time interval between injury and surgery	:	5 days
Procedure	:	ORIF with Lateral locking plate and Posteromedial T buttress plate
Post op period	:	uneventful
Knee mobilization	:	3rd day
Partial weight bearing	:	10th week
Full weight bearing	:	14th week
Follow up	:	18 months
HJ clinical outcome	:	Excellent
HJ functional outcome	:	Good
HJ radiological outcome	:	Excellent

PRE OP

IMMEDIATE POST OP

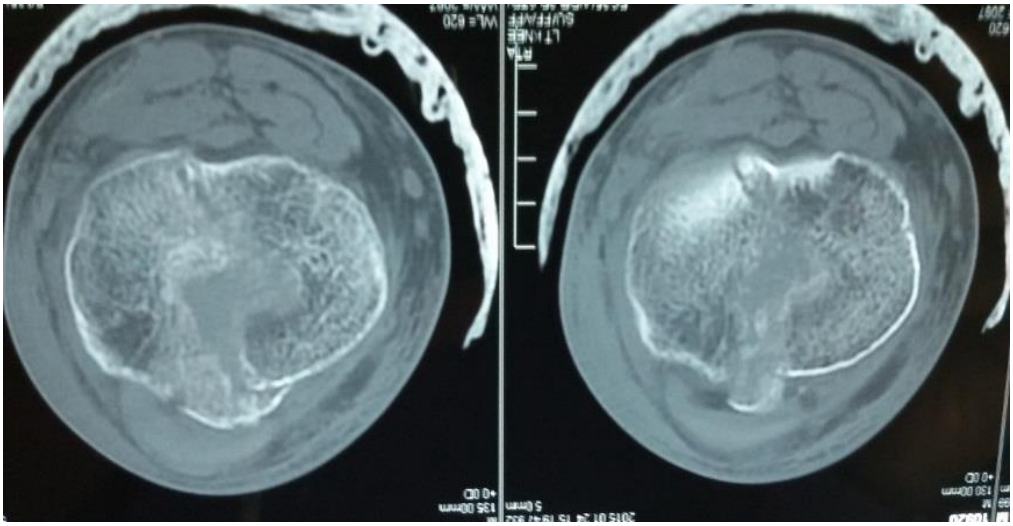
18 MONTHS POST OP

RANGE OF MOVEMENTS

CASE - 4

Patient Name	:	Nelson
Age	:	50 yrs.
Sex	:	Male
Mode of Injury	:	Road traffic accident
Type of fracture	:	Type V Scahtzker
Side of injury	:	Left
Time interval between injury and surgery	:	6days
Procedure	:	ORIF with Lateral Locking Plate and Posteromedial T buttress plate
Post op period	:	Uneventful
Knee mobilization	:	3rd day
Partial weight bearing	:	10th week
Full weight bearing	:	14th week
Follow up	:	18 months
HJ clinical outcome	:	Excellent
HJ functional outcome	:	Excellent
HJ Radiological outcome	:	Excellent


PRE OP



AXIAL CT


IMMEDIATE POST OP

18 MONTHS POST OP

RANGE OF MOVEMENTS

CASE - 5

Patient name	:	Ansari
Age	:	50 yrs.
Sex	:	Male
Mode of Injury	:	Road Traffic Accident
Side of Injury	:	Left Side
Type of fracture	:	Type VI Schatzker
Time interval between Injury and surgery	:	6days
Procedure	:	ORIF with Lateral Locking Plate and Posteromedial Semi tubular plate.
Post op period	:	Uneventful
Knee mobilization	:	8^{th}week
Partial weight bearing	:	10^{th}week
Full Weight bearing	:	14^{th} week
Follow up	:	16 months
HJ clinical outcome	:	Excellent
HJ functional outcome	:	Good
HJ Radiological outcome	:	Excellent

PRE OP

IMMEDIATE POST OP

16 MONTHS POST OP

RANGE OF MOVEMENTS

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BIBLIOGRAPHY

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MASTER CHART

MASTER CHART

Time of union (weeks)	15	14	11	12	12
Joint space narrowing (%)	<50%	None	<50%	None	None
Condylar widening(mm)	None	None	1-5mm	None	None
Articular step off(mm)	None	None	None	None	None
Varus / Valgus tilt(degree)	None	None	None	None	None
Plateau tilt (degree)	None	None	1-5°	None	None
Duck walking	A few steps	A few steps	One step	Normal	Normal
Jumping	Impaired	Impaired	Aided	Normal	Normal
Squatting	Impaired	Normal	Impaired	Normal	Normal
Stair climbing	Normal	Normal	Normal	Normal	Normal
Walking	Normal	Normal	Normal	Normal	Normal
Stability	Normal	Normal	Normal	Normal	Normal
Thigh atrophy(cm)	1	0	0	0	0
Knee flexion (degree)	125	129	100	131	133
Extension lag(degree)	None	None	None	None	None
Complication	Occasioanal pain	Implant prominence	Knee stiffness		Occasioanal pain
Follow up (months)	18	16	22	18	18
Procedure	Dual Plating	Dual Plating + BG	Dual Plating + BG	Dual Plating	Dual Plating
Schatzker type	V	VI	VI	V	V
Time delay before surgery (days)	8	6	3	6	5
Side injured	Right	Right	Left	Left	Left
Mode of Injury	RTA	RTA	RTA	RTA	RTA
IP no.	49486	54674	56744	98531	89452
Sex	M	M	F	M	M
Age	60	50	30	50	45
Name	Gopal	Ramesh babu	Mohana	Nelson	Sivanandhan
Sl no.	1.	2.	3.	4.	5.

13	14	12	16	11	11	13
>50%	None	None	None	None	None	None
1-5mm	1-5mm	None	None	None	None	None
1-3mm	None	None	None	None	None	None
None	None	None	None	None	None	None
1-5°	None	None	None	None	None	None
Unable	Normal	Normal	Normal	Normal	Normal	A few steps
Unable	Normal	Normal	Normal	Normal	Normal	Impaired
Impaired	Normal	Normal	Normal	Normal	Normal	Impaired
Impaired	Normal	Normal	Normal	Normal	Normal	Normal
Normal	Normal	Normal	Normal	Normal	Normal	Normal
Grade 1 AP Instability	Normal	Normal	Normal	Normal	Normal	Normal
0	0	0	0	0	0	0
124	131	131	135	135	131	125
None	None	None	None	None	None	None
Superficial infection			Occasioanal pain		Occasioanal pain	
16	12	15	10	16	20	18
Dual Plating + BG	Dual Plating	Dual Plating + BG	Dual Plating + BG	Dual Plating	Dual Plating	Dual Plating
VI	VI	VI	VI	VI	V	V
4	6	4	3	3	3	5
Right	Left	Right	Left	Left	Right	Left
RTA	RTA	RTA	RTA	RTA	RTA	RTA
99132	78467	44802	68901	54570	59024	68432
M	M	M	F	M	M	F
50	50	45	39	35	40	45
Babu	Ansari	Suresh kumar	Ranganayagi	Satish	Karupasamy	Raji
6.	7.	8.	9.	10.	11.	12.

11	12	16	15	13	14	11	12	12
None	<50%	<50%	None	None	None	None	None	None
None	None	1-5mm	None	None	None	None	None	None
None	1-3mm	None	None	None	None	None	None	None
None	None	None	None	None	None	None	None	None
None	1-5°	None	None	None	None	None	None	None
Normal	One step	One step	A few steps	Normal	Normal	Normal	A few steps	One step
Normal	Aided	Aided	Impaired	Normal	Normal	Normal	Impaired	Aided
Normal	Impaired	Impaired	Impaired	Normal	Normal	Normal	Impaired	Impaired
Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	normal
Normal	Normal	normal	Normal	Normal	Normal	Normal	Normal	Normal
Normal	Normal	Grade 1 AP Instability	Grade 1 AP	Normal	Normal	Normal	Grade 1 AP	Normal
0	0	1	0	0	0	0	0	0
132	120	95	125	132	135	130	125	120
None	None	None	None	None	None	None	None	None
		Knee Stiffness	Superficial				Superficial infection	
15	13	17	9	9	14	18	20	15
Dual Plating + BG	Dual Plating	Dual Plating	Dual Plating + BG	Dual Plating	Dual Plating	Dual Plating + BG	Dual Plating	Dual Plating + BG
VI	VI	V	VI	VI	V	VI	VI	VI
3	6	9	7	5	5	6	7	7
Left	Right	Right	Left	Left	Right	Right	Left	Left
RTA	RTA	RTA	RTA	RTA	RTA	RTA	RTA	RTA
90631	71400	61295	40397	72591	83104	86217	45713	60369
M	F	M	M	M	F	M	M	M
36	38	55	51	46	39	40	50	48
Arun	Kalyani	Godhandam	Muniyan	Ravi	Karthika	Suresh	Saleem	Albert
13.	14.	15.	16.	17.	18.	19.	20.	21.

PATIENT EVALUATION PROFORMA

Name :

Age / Sex :

IP number :

Address :

Contact Number :

Date of Admission :

Date of Surgery :

Date of Discharge :

Occupation :

Education :

Socioeconomic Status :

HISTORY:

1. Mode of injury : Road traffic accident / Pedestrian struck injury / Fall from height

2. Presenting complaints :
    a. Pain – site / duration
    b. Swelling – site / extent
    c. Deformity
    d. Disturbances in function of knee and ankle – movements / sensations
    e. Other associated injuries – head injury / limb injuries / spine injuries
3. Comorbid illnesses :

Diabetes mellitus		Hypertension		Coronary heart disease	
Renal disorder		Seizures /Neurological disorder		Hepatic disorder	
Dyslipidaemia		Endocrine disorder		Tuberculosis	
Bronchial Asthma		Chronic Obstructive lung diseases		Neoplastic disorders	

4. Drug history : Steroids / Disease modifying anti-rheumatoid drugs / Immunosuppressants

PAST HISTORY:

- Any similar injuries
- Previous surgeries or hospitalisations
- Any major illnesses

PERSONAL HISTORY:

Diet	Vegetarian / Mixed
Marital Status	Married / Single
Bowel and Bladder habits	Regular / Altered
Habits	Smoking / Alcohol / Tobacco / Drug Addictions / Others

OBSTETRIC & GYNAECOLOGY HISTORY:

TREATMENT HISTORY:

FAMILY HISTORY:

CLINICAL EXAMINATION:

GENERAL EXAMINATION:

- ☞ Appearance :
- ☞ Built :
- ☞ Pallor :
- ☞ Icterus :
- ☞ Cyanosis :
- ☞ Clubbing :
- ☞ Pedal Edema :
- ☞ Lymphadenopathy :

VITALS:

1. Pulse :
2. BP :
3. Respiratory rate :
4. Temperature :

SYSTEMIC EXAMINATION:

- ☞ Cardiovascular system :
- ☞ Respiratory system :
- ☞ Abdomen :
- ☞ Central Nervous System :

REGIONAL EXAMINATION

RIGHT /LEFT LEG

OTHER INJURIES

X – RAY FINDINGS

3D CT RIGHT/LEFT KNEE JOINT WITH PROXIMAL TIBIA (If needed)

INVESTIGATIONS:

Hb%		TC		DC	P L B E M
ESR		BT/CT		RBS	
UREA		S.CREATININE		ELECTROLYTES	Na^+ K^+
HBsAg		HIV		VDRL	
CXR		ECG		URINE ROUTINE ALBUMIN SUGAR DEPOSITS	
Blood G & T					

FINAL DIAGNOSIS:
INITIAL TREATMENT GIVEN:

PLANNED SURGERY :

PROCEDURE NOTES

POST OP PERIOD:

FOLLOW UP **(After discharge)**	**CLINICAL FINDINGS**	**X–RAY FINDINGS**	**ADVICE**
FIRST WEEK			
SECOND WEEK			
FIRST MONTH			
SECOND MONTH			
THIRD MONTH			
SIXTH MONTH			
NINTH MONTH			
ONE YEAR			
ONE YEAR SIX MONTHS			
TWO YEAR			

OUTCOME:

PATIENT CONSENT FORM

Study detail: " ***A STUDY ON FUNCTIONAL AND RADIOLOGICAL OUTCOME OF HIGH VELOCITY TIBIAL PLATEAU FRACTURES MANAGED BY DUAL PLATING*** "

Study centre : KILPAUK MEDICAL COLLEGE, CHENNAI

Patients Name :

Patients Age :

Identification Number :

Patient may check (✓) these boxes

I confirm that I have understood the purpose of procedure for the above study. I have the opportunity to ask question and all my questions and doubts have been answered to my complete satisfaction. ☐

I understand that my participation in the study is voluntary and that I am free to withdraw at any time without giving reason, without my legal rights being affected. ☐

I understand that sponsor of the clinical study, others working on the sponsor's behalf, the ethical committee and the regulatory authorities will not need my permission to look at my health records, both in respect of current study and any further research that may be conducted in relation to it, even if I withdraw from the study I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published, unless as required under the law. I agree not to restrict the use of any data or results that arise from this study. ☐

I agree to take part in the above study and to comply with the instructions given during the study and faithfully cooperate with the study team and to immediately inform the study staff if I suffer from any deterioration in my health or well-being or any unexpected or unusual symptoms. ☐

I hereby consent to participate in this study. ☐

I hereby give permission to undergo complete clinical examination and diagnostic tests including hematological, biochemical, radiological tests. ☐

Signature/thumb impression:

Patients Name and Address: place date

Signature of investigator :

Study investigator's Name : place date

நோயாளி ஒப்புதல் படிவம்

ஆராய்ச்சியின் விவரம் : தொடை எலும்பு மேல்பகுதி எலும்புமுறிவிற்கு தகடு பொருத்தும் சிகிச்சையின் முடிவுகளை அறியும் ஆய்வு.

ஆராய்ச்சி மையம் : அரசு கீழ்பாக்கம் மருத்துவக் கல்லூரி மருத்துவமனை

நோயாளியின் பெயர் : நோயாளியின் வயது:

பதிவு எண் :

நோயாளி கீழ்கண்டவற்றுள் கட்டங்களை (✓) செய்யவும்

1 மேற்குறிப்பிட்டுள்ள ஆராய்ச்சியின் நோக்கத்தையும் பயனையும் முழுவதுமாக புரிந்து கொண்டேன். மேலும் எனது அனைத்து சந்தேங்களையும் கேட்டு அதற்கான விளக்கங்களையும் தெளிவுபடுத்திக் கொண்டேன். ☐

2 மேலும் இந்த ஆராய்ச்சிக்கு எனது சொந்த விருப்பத்தின் பேரில் பங்கேற்கிநேன் என்றும், மேலும் எந்த நேரத்திலும் எவ்வித முன்றிவிப்பு மின்றி இந்த ஆராய்ச்சியிலிருந்து விலக முழுமையான உரிமை உள்ளதையும் இதற்கு எவ்வித சட்ட பிணைப்பும் இல்லை என்பதையும் அறிவேன். ☐

3 ஆராய்சியாளரோ, ஆராய்ச்சி உதவியாளரோ, ஆராய்ச்சி உபயத்தாரரோ, ஆராய்ச்சி பேராசிரியரோ, ஒழுங்குநெறி செயற்குழு உறுப்பினர்களோ எப்போது வேண்டுமானாலும் எனது அனுமதியின்றி எனது உள்நோயாளி மற்றும் புற நோயாளி பதிவுகளை இந்த ஆராய்ச்சிக்காகவோ அல்லது எதிர்கால பிறஆராய்ச்சிகளுக்காகவோ பயன்படுத்திக் கொள்ளலாம் என்றும் மேலும் இந்த நிபந்தனை நான் இவ்வராய்ச்சிலிருந்து தகும் என்றும் ஒப்புக்கொள்கிறேன். ஆயினும் எனது அடையாளம் சம்பந்தப்பட்ட எந்த பதிவகளும் (சட்டபூர்வமான தேவைகள் தவிர) வெளியிடப்படமாட்டது என்ற உறுதிமொழியின் பெயரில் இந்த ஆராய்ச்சிலிருந்து கிடைக்கப்பெறும் முடிவுகளை வெளியிட மறுப்பு தெறிவிக்கமாட்டேன் என்று உறுதியளிக்கிறேன். ☐

4. இந்த ஆராய்ச்சி, அதன் பயன்பாடுகளையும், பின் விளைவுகளையும் அறியும் முயற்சி என்பதை மருத்துவர் மூலம் அறிந்து கொண்டேன். ☐

5. இந்த ஆராய்ச்சிக்கு நான் முழுமனதுடன் சம்மதிக்கின்றேன் என்றும் மேலும் ஆராய்ச்சி குழுவினர் எனக்கு அளிக்கும் அறிவுரைகளை தவறாது பின்பற்றுவேன் என்றும் உறுதியளிக்கிறேன். ☐

6. இந்த ஆராய்ச்சிக்குத் தேவைப்படும் அனைத்து மருத்துவப்பரிசோதனைகளுக்கும் ஒத்துழைப்பு தருவேன் என்று உறுதியளிக்கிறேன். ☐

7. இந்த ஆராய்ச்சிக்கு யாருடைய வற்புறுத்தலுமின்றி எனது சொந்த விருப்பத்தின் பேரிலும் சுயஅறிவுடனும் முழுமனதுடனும் சம்மதிக்கின்றேன் என்று இதன் மூலம் ஒப்புக்கொள்கிறேன். ☐

நோயாளியின் கையொப்பம் / பெருவிரல் கைரேகை

இடம்: தேதி:

ஆராய்ச்சியாளரின் கையொப்பம்:

இடம்: தேதி: